

Remarks

Reconsideration and reversal of the rejections expressed in the Office Action of November 27, 2006 are respectfully contended in view of the following remarks and the application as amended. The present invention relates to a Cu damascene structure, which is formed by treating the top surface of the surrounding low-k interlayer dielectric with a nitrogen or carbon containing medium, to form a silicon nitride or silicon carbide diffusion barrier, rather than capping the top surface of the Cu with a metal diffusion barrier, as is conventionally done.

Claims 1, 17, 20, 21-25, 26, 28 and 29 were rejected under 35 U.S.C. §103(a) as being unpatentable over Leu et al., U.S. 2003/0205823 in view of Kakamu et al., U.S. 2004/0041267. The Office Action states, inter alia, that while Leu et al. fails to specifically disclose treating the surface of the low-k interlayer dielectric layer employing ion implantation using carbon dioxide, it would have been obvious to modify Leu et al. by treating the surface of the low-k layer with plasma/ion implantation formed from carbon dioxide as per Kakamu et al.

Leu et al. relates to a method to improve nucleation and/or adhesion of a CVD or ALD-deposited film/layer onto a low-dielectric constant (low-k) dielectric layer, such as a polymeric dielectric or a carbon-doped oxide. Kakamu et al. discloses a semiconductor device that contains an MOS (Metal Oxide Semiconductor) transistor, and especially relates to a semiconductor device wherein change of threshold voltage with time and degradation of drain saturation current with time are prevented from occurring.

Applicants respectfully contend that the processes of chemical vapor deposition (CVD) and ion implantation are distinct and discrete, and there would be no reasonable expectation that ion implantation would be effective in the practice of Leu et al. Note that CVD is a chemical process used to produce thin films, while ion implantation is a materials engineering process by which the ions of a material are implanted into another solid, thereby changing the physical properties of the solid. Furthermore, in order to enhance the prosecution of the present application, the claims have been further clarified so as to exclude the process gas tetra methyl silane, disclosed in paragraph [0056] of Kakamu et al. (“...*process gas being tetra methyl silane* ($\text{Si}(\text{CH}_3)_4$) and carbon dioxide” (emphasis added)) Therefore, prima facie obviousness is not established.

Claims 27 and 30 were rejected under 35 U.S.C. §103(a) as being unpatentable over Leu et al., U.S. 2003/0205823 in view of Kakamu et al., U.S. 2004/0041267, and further in view of De Felipe et al., U.S. Patent No. 6,541,374. This rejection is overcome based on the previous discussion.

For all of the above reasons, it is respectfully contended that the solicited claims define patentable subject matter. Reconsideration and reversal of the rejections expressed in the Office Action of November 27, 2006 are respectfully submitted. The Examiner is invited to call the undersigned if any questions arise during the course of reconsideration of this matter.

Respectfully submitted,

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